I claim:

1. A method of reconstructing images from data provided by at least one detector, comprising the steps of:

scanning an object in the spiral fashion with at least one detector that detects at least one cone beam projection, the cone beam projection being wider in the axial direction than projections of four turns of the spiral that are adjacent to a current source position; and

reconstructing an exact image of the scanned object in an efficient manner with a convolution based FBP (Filtered Back Projection) algorithm.

2. The method of claim 1, wherein the scanning step includes acquiring two-dimensional cone beam (CB) projection data of the object using the detectors.

3. The method of claim 2, further comprising the step of:

using the detectors substantially similar to those required for a 1PI algorithm.

4. The method of claim 2, wherein the scanning step further includes the step of:

detecting the cone beam projection being wider in the axial direction as compared to a cone beam projection used in a 1PI algorithm.

5. The method of claim 4, wherein the scanning step further includes the step of: detecting the cone beam projection being wider by a factor of at least three times in the axial direction as compared to a cone beam projection used in a 1PI algorithm.

6. The method of claim 1, wherein the object includes: a person.

7. A method of computing exact images derived from spiral computer tomography scan with area detectors, comprising the steps of:

(a) collecting cone beam (CB) projection data from a detector, which is wider than what is required for a 1PI algorithm; the cone beam covering projections of four turns of the spiral that are adjacent to a current source position;

(b) identifying families of lines on a plane Π intersecting the cone beam projection;

(c) preprocessing the CB projection data;

(d) convolution-filtering said preprocessed CB projection data along said lines;

(e) back projecting said filtered data to form a precursor of said image; and

(f) repeating steps a, b, c, d, e, until an exact image of the object is completed.

8. The method of claim 7, wherein the scan includes an x-ray exposure of the object.

9. The method of claim 7, wherein the steps (a) – (f) include: a 3PI algorithm.

10. A method of computing images derived from computer tomography scan with detectors, comprising the steps of:

(a) collecting cone beam (CB) data from a detector during a scan of an object;

(b) identifying three families of lines on a plane $DP(s)$ intersecting the cone beam, wherein s is value of the parameter describing the scan path and corresponding to the current source position, and the three families of lines include:

(bi) a first family of lines parallel to $\dot{y}(s)$, where

$\dot{y}(s)$ is the direction of the scan tangent at the current source position;

(bii) a second family of lines tangent to Γ_1 and Γ_{-1}, where

Γ_1 is the projection of the scan turn defined by $s < q < s + 2\pi$ onto the plane $DP(s)$;

Γ_{-1} is the projection of the scan turn defined by $s - 2\pi < q < s$ onto the plane $DP(s)$;

q is the parameter along the scan path which describes the point being projected;

(biii) a third family of lines tangent to Γ_2 and Γ_{-2}, where

Γ_2 is the projection of the scan turn defined by $s + 2\pi < q < s + 4\pi$ onto the plane $DP(s)$;

Γ_{-2} is the projection of the scan turn defined by $s - 4\pi < q < s - 2\pi$ onto the plane $DP(s)$;

(c) preprocessing and shift invariant filtering said data along said lines of said three families;

(d) back projecting said filtered data to form a precursor of said image; and

(e) repeating steps a, b, c, and d until an image of the object is completed.

11. The method of claim 10, wherein the preprocessing includes calculation of the derivative of the CB data with respect to source position.

12. The method of claim 10, wherein the shift invariant filtering includes convolving the said preprocessed data with filter $1/\sin\gamma$.

13. The method of claim 10, wherein back projecting said filtered data from the first family of lines involves multiplying the said filtered data by the coefficient $c_m = 2/3$, when the projection of x onto $DP(s)$ is located between L_2^{cr} and L_{-2}^{cr}, where

L_2^{cr} is the line parallel to $\dot{y}(s)$ and tangent to Γ_2;

L_{-2}^{cr} is the line parallel to $\dot{y}(s)$ and tangent to Γ_{-2}.

14. The method of claim 10, wherein back projecting said filtered data from lines in the first family of lines involves multiplying the said filtered data by the coefficient $c_m = 1/3$, when the projection of x onto $DP(s)$ is located above L_2^{cr} or below L_{-2}^{cr}.

15. The method of claim 10, wherein back projecting said filtered data from a line in the second family of lines involves multiplying the said filtered data by the coefficient

$c_m = 2/3$, when the projection of x onto $DP(s)$ is located between Γ_1 and Γ_{-1} and the point where the line is tangent to $\Gamma_1 \cup \Gamma_{-1}$ is inside the 1PI parametric interval of x.

16. The method of claim 10, wherein back projecting said filtered data from a line in the second family of lines involves multiplying the said filtered data by the coefficient $c_m = -2/3$, when the projection of x onto $DP(s)$ is located between Γ_1 and Γ_{-1} and the point where the line is tangent to $\Gamma_1 \cup \Gamma_{-1}$ is outside the 1PI parametric interval of x.

17. The method of claim 10, wherein back projecting said filtered data from a line in the third family of lines involves multiplying the said filtered data by the coefficient $c_m = 1/3$.

18. A method of computing images derived from computer tomography scan with detectors, comprising the steps of:

(a) collecting cone beam data from a detector during a scan of an object;

(b) identifying three families of lines on a plane $DP(s)$ intersecting the cone beam, wherein s is value of a parameter describing the scan path and corresponding to the current source position, and the three families of lines include:

(bi) a first family of lines parallel to $\dot{y}(s)$, where

$\dot{y}(s)$ is the direction of the scan tangent at the current source position;

(bii) a second family of lines tangent to Γ_1 and Γ_{-1}, where

Γ_1 is the projection of the scan turn defined by $s < q < s + 2\pi$ onto the plane $DP(s)$;

Γ_{-1} is the projection of the scan turn defined by $s - 2\pi < q < s$ onto the plane $DP(s)$;

q is the parameter along the scan path which describes the point being projected;

(biii) a third family of lines on the plane $DP(s)$ that have at least three points of intersection s_1, s_2, s_3 with $\Gamma_{\pm 1}$ and $\Gamma_{\pm 2}$, where

Γ_2 is the projection of the scan turn defined by $s + 2\pi < q < s + 4\pi$ onto the plane $DP(s)$;

Γ_{-2} is the projection of the scan turn defined by $s - 4\pi < q < s - 2\pi$ onto the plane $DP(s)$;

(c) preprocessing and shift invariant filtering said data along said lines of said three families;

(d) back projecting said filtered data to form a precursor of said image; and

(e) repeating steps a, b, c, and d until an image of the object is completed.

19. The method of claim 18, wherein the points of intersection s_1, s_2, s_3 are determined according to the following rules:

$s_1 - s = \psi(s_3 - s_2)$ if $s + 2\pi < s_3 < s + 4\pi$,

$s_3 - s_2 = \psi(s_1 - s)$ if $s - 4\pi < s_3 < s - 2\pi$,

where $\psi(t)$ is a function with the properties $\psi(0) = 0$, $\psi'(t) > 0, t \in \mathrm{R}$.

20. The method of claim 18, wherein the preprocessing includes calculation of the derivative of the CB data with respect to source position.

21. The method of claim 18, wherein the shift invariant filtering includes convolving the said preprocessed data with filter $1/\sin\gamma$.

22. The method of claim 18, wherein back projecting said filtered data from lines in the first family of lines involves multiplying the said filtered data by the coefficient $c_m = 2/3$, when the projection of x onto $DP(s)$ is located between L_2^{cr} and L_{-2}^{cr}.

23. The method of claim 18, wherein back projecting said filtered data from a line in the second family of lines involves multiplying the said filtered data by the coefficient $c_m = 2/3$, when the projection of x onto $DP(s)$ is located between Γ_1 and Γ_{-1} and the point where the line is tangent to $\Gamma_1 \cup \Gamma_{-1}$ is inside the 1PI parametric interval of x.

24. The method of claim 18, wherein back projecting said filtered data from a line in the second family of lines involves multiplying the said filtered data by the coefficient $c_m = -2/3$, when the projection of x onto $DP(s)$ is located between Γ_1 and Γ_{-1} and the point where the line is tangent to $\Gamma_1 \cup \Gamma_{-1}$ is outside the 1PI parametric interval of x.

25. The method of claim 18, wherein back projecting said filtered data from lines in the third family of lines involves multiplying the said filtered data by the coefficient $c_m = 2/3$, when the projection of x onto $DP(s)$ is located above L_2^{cr} or below L_{-2}^{cr}.

26. A method of identifying a family of lines used for reconstructing images based on a scan of an object in a computer tomography system, comprising the steps of

(i) fixing current source position s, where s is a parameter describing the scan path;

(ii) picking a plane $DP(s)$ intersecting the cone beam projection;

(iii) choosing three points on the scan path, which are described using values of the parameter as s_1, s_2, s_3, such that:

(iiia) $|s - s_1| < 2\pi$,

(iiib) either $2\pi < s_2 - s < 4\pi$ and $2\pi < s_3 - s < 4\pi$ or $-4\pi < s_2 - s < -2\pi$ and $-4\pi < s_3 - s < -2\pi$;

(iiic) $s_1 - s = \psi(s_3 - s_2)$ if $2\pi < s_3 - s < 4\pi$ or $s_3 - s_2 = \psi(s_1 - s)$ if $-4\pi < s_3 - s < -2\pi$, where $\psi(t)$ is a function with $\psi(0) = 0$, $\psi'(t) > 0, t \in \mathrm{R}$;

(iv) projecting the three said points onto $DP(s)$; and

(v) drawing a line through the said projections.